

John F. Kennedy Space Center's Apparatus and Method for Testing Thermal Performance of Pipelines



The National Aeronautics and Space Administration (NASA) seeks to license its Thermal Insulation Performance Analyzer technology and method to private industry. NASA is also willing to provide industry access to the technology, which was developed at John F. Kennedy Space Center (KSC) Cryogenics Test Laboratory, for testing and consulting purposes. The technology includes testing hardware and a testing procedure that are used to measure the thermal performance of insulated process piping. It was developed for testing the thermal insulation systems of cryogenic pipelines containing fluids, such as liquid nitrogen, used in the launching of the Space Shuttle. The hardware includes two cold boxes mounted on each end of a section of pipe with a unique flange and bellows feed-through arrangement to allow for the flow of cryogen. The system can accommodate up to three different pipelines in lengths of 60 ft or longer. Also, this testbed can be easily adapted for dynamic testing using not only cryogenics but also chilled water or other working fluids. Currently there is no standard reference test procedure or device available to industry. KSC's testing technology lends itself very well to the development of an industry standard apparatus and procedure.

BENEFITS

- Enables both static and dynamic testing. Technology and method are accurate.
- Provides a direct measurement method based on temperature change and mass flow.
- Determines the true performance of the insulation.
- Saves cost in cryogenic applications by preventing boiloff and providing process control.

opportunity

APPLICATIONS

- Manufacturers and service providers for the medical, food storage, aerospace, and semiconductor and other cryogenics industries seeking to test their thermal insulated pipes.
- Fuel and oil companies responsible for transferring products such as liquid nitrogen and liquefied natural gas. Also, offshore oil operations needing to keep the oil in pipelines warm to prevent clumping and clogging.
- Future energy storage. Superconducting cables in the future may need to be insulated and cooled by liquid nitrogen. Piping insulation will need to be tested to ensure efficient transfer of the electrical energy.

TECHNOLOGY STATUS

- ☐ Patent pending
- ☒ U.S. Patent No. 6,715,914
- ☐ Copyrighted
- ☒ Available to license
- ☐ Available for no-cost transfer
- ☐ Seeking industry partner for further codevelopment

Technology Details

The KSC Thermal Insulation Performance Analyzer is fully developed and in use on site at the Cryogenics Test Laboratory. In operation, a cooled cryogen is pumped through the upstream cold box into the pipe being tested. Both ends of the pipe are held at a constant temperature, so the heat transfer is eliminated in the axial direction and is limited to the radial direction. A precise measurement of the rate of heat leak into the process fluid is needed in this process. The technology operates on the theory that the heat leak is equal to the boiloff rate multiplied by the latent heat of vaporization. A heat leak rate is computed while maintaining the temperature of the cold boxes at the end of the pipe and measuring the boiloff rate. Thermally isolated valves, plumbing, and safety devices within the cold boxes allow for convenient and efficient controls and a repeatable procedure. All test measurements are recorded on a field-portable data acquisition system with a laptop computer.

Partnership Opportunities

NASA has been issued a U.S. patent on the technology and is seeking licensees of the patent. NASA has the authority to grant licenses on its domestic and foreign patents and patent applications pursuant to 35 U.S.C. 207-209. NASA has implemented this authority by means of the NASA Patent Licensing Regulations, 37 CFR § 404. All NASA licenses are individually negotiated with the prospective licensee, and each license contains terms concerning commercialization (practical application), license duration, royalties, and periodic reporting. NASA patent licenses may be exclusive, partially exclusive, or non-exclusive. If your company is interested in the Apparatus and Method for Testing Thermal Performance of Pipelines technology, or if you desire additional information, please reference Case Number KSC-12205 and contact:

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